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# Effect of Vermicompost on Growth, Yield and Quality of Vegetable Crops

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**Abstract**

***Vermicomposting is a promising method of transforming unwanted and virtually unlimited supplies of organic wastes into usable substrates. In this process, the digestive tracts of certain earthworm species (e.g., Eisenia fetida) are used to stabilize organic wastes. The final product is an odorless peat-like substance, which has good structure, moisture-holding capacity, relatively large amounts of available nutrients, and microbial metabolites that may act as plant growth regulators. For these reasons, vermicompost has the potential to make a valuable contribution to soilless potting media. The objective of this study was to evaluate the transplant quality and field performance of vegetable transplants grown in vermicompost. Tomato (Lycopersicon esculentum Mill.), Eggplant (Solanum melongena L.), Pepper (Capsicum annuumL.), Potato, Sweet corn hybrids, Pak choi, Spinach and Turnip. Growth of vegetable transplants was positively affected by addition of vermicompost, perhaps by altering the nutritional balance of the medium. Transplant quality was improved in peppers and eggplants while tomato transplant quality was slightly reduced. There were no significant differences in field performance. Hence, vermicomposting is a sustainable technique for solid waste disposal. Vermicomposting is the science of producing compost from biodegradable organic matters through earthworms. Vermicompost contains significant quantities of nutrients, a large beneficial microbial population and biologically active metabolites, particularly gibberellins, cytokines, auxins and group B vitamins which can be applied alone or in combination ith organic or inorganic fertilizers so as to get better yield and quality of diverse crops.***

***Key Word: Vermicompost, Yield, quality, Tomato, Sweet peaper, potato, Sweet corn hybrids, Pak choi, Spinach and Turnip.***

## I. Introduction

Green revolution can be attained through adopting the technologies such as countless use of synthetic chemicals like fertilizers and pesticides, adoption of nutrientresponsive, high-yielding varieties of crops, greater exploitation of irrigation potentials etc. has boosted the production output in most cases. However, continuous use of these high energy inputs indiscriminately now leads to decline in production and productivity of various crops as well as deterioration of soil health and environments. There is no doubt that in India, where on one side pollution is increasing day by day due to accumulation of organic waste and on the other side there is a great shortage of organic manure. The organic manure could increase the fertility and productivity of the land and produce nutritive and safe food (Ramesh *et al.*, 2005). Recycling biowaste of different resources in the form of compost can be an alternative to meet the increasing demands for organic manures; this will also help to reduce environmental pollution arising out of accumulated biowastes (Kumar, 2005). Biowastes could be recycled by adopting simple

 

and suitable techniques in compost making and preparing enriched manure. These improved technologies not only reduce the quantity but also improve the quality of compost with better plant nutrients (Jagadeesan, 2005).

In today's era, heavy doses of chemical fertilizers and pesticides are being used by the farmers to get a better yield of various field crops. These chemical fertilizers and pesticides decreased soil fertility and caused health problems to the consumers. Due to adverse effects of chemical fertilizers, interest has been stimulated for the use of organic manures. (Follet *et al.*, 1981).

The 'Green Revolution' in the 1960s and 70s ushered by the heavy use of agro-chemicals, increased food productivity but also created several socio-economic and environmental problems like decreased nutritional quality of food produced, decreased soil fertility, higher demand for water for irrigation, soil and water pollution and pesticide poisonings (Sinha 1998 and 2004, Sinha et al. 2009). The pesticide remains in vegetables can cause neurological and blood disorders, lung ailments and affect the reproductive system of women (Mandal, 2009). Sharma (2009) reported that indiscriminate use of chemical fertilizers in the wake of Green Revolution in India has pushed the State to the brink of health hazards like 'blue baby syndrome' and cancer man civilization.

Urban centers throughout the world have experienced substantial increase in population; this growth is \ accompanied with change in food habits and rising concerns for food quality. Here, food quality refers to the optimum levels of the nutrition in the food along with the minimized amount of the chemical (pesticides/fertilizers) residues used in the production of the crop. Agriculture is also entrusted with a role of restoring environmental imbalance created due to injudicious/ indiscriminate use of the chemicals in the agriculture.

Along with these issues, increasing demands for fuel crops for sustaining the rapidly growing economies is needed. According to the estimates of UN population projection, world population could reach 9.15 billion by 2050, thus the expected rate of increase in world population will be 2.25 percent over the next forty years. However, recent research work into the effects of vermicompost utilization on vegetables crop, have been very limited. In the present review paper the main objectives are to investigation the effects of vermicompost applications on the growth, yield and quality of vegetable crops.

**Effect of vermicompost on tomato**

Rakesh Joshi *et al.*, (2010) prepared and reported the Cattle dung vermicompost (VC) of different proportions mixtures namely Soil (control), VC15 (Soil+15% VC), VC30 (Soil+30% VC), VC45 (Soil+45% VC). Vermicompost was chemically analysed for various parameters like pH, Total Kjeldahl Nitrogen (TKN), Total Available Phosphorous (TAP), Total Sodium (TNa), Total Organic Carbon (TOC) and Electric Conductivity (EC). Germination percentage was noticed for each treatment. Randomly selected seedlings from each treatment were transplanted in pots containing same treatments as in trays. Various growth and yield parameters like mean stem diameter, mean plant height, yield/plant, marketable yield/plant, mean leaf number, total plant biomass were recorded for each treatment. Various quality parameters like ascorbic acid, titrable acidity, soluble solids, insoluble solids and pH were recorded for tomatoes from each treatment. Germination percentage was found the maximum at VC15 treatment that decreased in the subsequent treatments. Almost all the growth, yield and quality parameters increased significantly as compared to control, though the increase within the treatments was not found to be significant.

Tahmineh Bahrampour (2013) determined the effect of vermicompost on growth, yield and fruit quality of tomato *(Lycopersicum esculentum)* var. Super Beta) in a field condition. The experiment was a randomized complete block design with four replications. The different rates of vermicompost (0, 5,

 

10 and 15 t ha-1) were incorporated in to the top 15 cm of soil. During experiment period, fruits were harvested twice in a week and total yield were recorded for two months. At the end of experiment, growth characteristics such as leaf number, leaf area and shoot dry weights were determined. The results revealed that addition of vermicompost with rate of 15 t ha-1 significantly (at $p<0.05$) increased growth and yield compared to control. Vermicompostith rate of 15 t ha-1 increased Ec of fruit juice and percentage of fruit dry matter up to 30 and 24%, respectively. The content of K, P, Fe and Zn in the plant tissue increased 55, 73, 32 and 36% compared to untreated plots respectively. The result of our experiment showed addition of vermicomlost had significant ($P<0.05$) positive effect on growth, yield and elemental content of plant as compared to control.

Goutam Kumar Chanda *et al.*, (2011) studied on the effect of vermicompost and other fertilizers on cultivation of tomato plants using different fertilezers having equal concentration of nutrients to determine their impact on different growth parameters of tomato plants. Six types ofexperimental plots were prepared where T1 was kept as control and five others were treated by different category of fertilizers (T2-Chemical fertilizers, T3-Farm Yard Manure (FYM), T4-Vermicompost, T5 and T6- FYM supplemented with chemical fertilizers and vermicompost supplemented with chemical fertilizer respectively).The treatment plots (T6) showed 73% better yield of fruits than control, Besides, vermicompost supplemented with N.P.K treated plots (T5) displayed better results with regard to fresh weight of leaves, dry weight of leaves, dry weight of fruits, number of branches and number of fruits per plant from other fertilizers treated plants.

**Effect of vermicompost on sweet peaper**

Sahel Miladi Lari (2014) In order to evaluation of effect of cocpeat and vermicompost biofertilizers at different ratio's as media on qualitative traits of pepper, a factorial experiment in randomized completely block design with three replication in research greenhouse of 10 municipality of Tehran is done. Experimental treatments were: 1-vermicompost: perlite(1:1) 2-cocopeat: vermicompost (1:1) 3-cocopeat: perlite: vermicompost (2:1:1)4-cocopeat: perlite:vermicompost (1:2:1) 5-cocopeat: perlite: vermicompost(1:1:2) 6-cocopeat: perlite(1:1)andthethree varieties of Capsicum were as follows: Capsicum annum var. Alonso, Roxy, Baiela The result demonstrated that there are a significant difference in amount of Chlorophyll a in 1% and Chlorophyll b and Carotenoids was significant at the 5% level of significance. Different varieties have different answers to the substrates, so that chlorophyll a and b Alonso cultivar has highest average and in carotenoids Roxy has highest and Baiela least average. The results of vermicompost and perlite : cocopeat (2:1:1) in characters Chlorophyll a and b, has the highest average. Finally The vermicompost: perlite : cocopeat (1:1:2) was have highest average of carotenoids.

Narkhede, S. D. *et al.*, (2011) Increase in application of inorganic fertilizers in agriculture has detoriated the soil quality. Vermicompost as a soil conditioner has been emerging as a potential end use for maintaining soil productivity. The paper examines the effect of chemical fertilizer and vermicompost on the growth of Capsicum annum crop. Initially analysis of soil was done in order to know its composition and lacking nutrients. Urea as chemical fertilizer was applied for the comparative study with vermicompost. Fertilizer at the rate of 0, 5, 10, 15 and 20% concentration was applied in the plot. Plant height, leaf length, number of leaves per plant, chlorophyll content in leaves, fresh weight, dry weight etc. were measured. Significant increase in plant height, leaf length and fruit yield of pepper plants was observed in plots treated with vermicompost. Maximum leaf chlorophyll content, 2.9% was estimated from the vermicomposting plot of 20%. Effective results were obtained after application of

 

organic fertilizer as compared to the chemical fertilizer. Hence, in some fields if organic fertilizer applied at appropriate dose, it shows the potential to act as growth promoter for particular crop.

Maria Angela Oliva Llaven *et al.,* (2008). The effects of earthworm-processed sheep manure (vermicompost) on growth, productivity, and characteristics of bell pepper fruits (*Capsicum annum*) (cv 'Ancho supremo') were investigated in a greenhouse experiment. Six treatments were applied combining vermicompost and soil in 0:1, 1:1, 1:2, 1:3, 1:4, and 1:5 (v/v) ratios. Plant characteristics were measured 21 and 90 days after transplanting. Addition of vermicompost increased plant size significantly with 8 cm in the 1:3 vermicompost: soil treatment compared to the unamended soil after 21 days, but no significant differences were found after 90 days. Seven more flowers were found in the 1:2 vermicompost: soil treatment and four in the 1:3 vermicompost: soil treatment compared to the unamended soil after 90 days. The number of marketable fruits per plant was significantly 1.5 and 1.9 times greater in the 1:2 and 1:3 vermicompost: soil treatments compared to plants cultivated in unamended soil after 90 days. The addition of vermicompost to soil increased soluble solids in pepper fruits > 2 Brix compared to fruits from plants cultivated in unamended soil while their pH was significantly lower. The nitrogen (N) content of the pepper fruits was significantly higher in the 1:4 vermicompost: soil mixture compared to the other treatments, whereas the fruits obtained from plants cultivated in the 1:3 and 1:4 vermicompost: soil treatments had higher titratable acidity values than in those from other treatments. It was found that amounts and characteristics of pepper fruits from plants cultivated in soil.

**Effect of vermicompost on sweet corn hybrids (*zea mays* )**

Cristina Lazcano *et al.,* (2011). Vermicompost has been proposedasa valuable fertilizer for sustainable agriculture. The effects of vermicompost on yield and quality of sweet corn were evaluated in this study. In two field trials, sweet corn plants were grown under (i) a conventional fertilization regimewith inorganic fertilizer, and integrated fertilization regimesinwhich75%ofthenutrientswere supplied by the inorganic fertilizer and 25% of the nutrients were supplied by either (ii) rabbit manure, or (iii) vermicompost. All three types of fertilization regime were supplied at two doses. Two pairs of nearly isogenic sweet corn hybrids homozygous for sugary1 and shrunken2 mutants were included in the trials to explore fertilizer × genotype interactions. Growth, yield and ear quality of the plants were evaluated in relation to the three fertilization regimes. RESULTS: In general, the integrated regimes yielded the same productivity levels as the conventional treatment. Moreover, both vermicompost and manure produced significant increases in plant growth and marketable yield, and also affected the chemical composition and quality of the marketable ear. Nevertheless, most of the observed effects of the organic fertilizers were genotype-dependent. Conclusion: The results confirm that the use of organic fertilizers such as vermicompost has a positive effect on crop yield and quality. Nevertheless, these effects were not general, indicating the complexity of the organic amendment–plant interactions and the importance of controlling genetic variation when studying the effects of vermicompost on plant growth._c 2011 Society of Chemical Industry.

**Pak choi (*brassicarapa* cv. bonsai, chinensis group)**

Archana, P. Pant *et al.,* (2009). Studies have been reported on the effect of compost tea on suppression of certain plant diseases. However, relatively little work has been done to investigate the effect of vermicompost tea on yield and nutritional quality of vegetable crops. In this study, experiments were conducted to determine the effect of extraction method on vermicompost tea quality and subsequent effects on growth, mineral nutrients, phytonutrients and antioxidant activity of pak choi

 

plants grown under organic (vermicompost) and synthetic (Osmocote) fertilisation. Three vermicompost teas obtained by different extraction methods, namely non-aerated vermicompost tea (NCT), aerated vermicompost tea (ACT) and aerated vermicompost tea augmented with microbial enhancer (ACTME), were applied to the plants. Aerated water served as control. RESULTS: Mineral nutrients were significantly higher in ACTME compared with other teas, but total microbial population and activity did not differ with extraction method. All vermicompost teas similarly enhanced plant production, mineral nutrients and total carotenoids, and this effect was most prominent under organic fertilisation. Antioxidant activity and total phenolics were higher under organic compared with synthetic fertilisation. Vermicompost teas generally decreased phenolics under organic fertilisation and increased them under synthetic fertilisation compared with the control. Conclusion: The effect of vermicompost tea on crop growth is largely attributable to mineral nutrient, particularly N, uptake by plants. Non-significant differences among extraction methods on plant response within fertiliser regimes suggest that aeration and additives are not necessary for growth promotion and nutrient quality under the conditions reported here. _c 2009 Society of Chemical Industry.

**The Productivity of Potato (*Solanum tuberosum*), Spinach (*Spinacia oleracea*) and Turnip (*Brassica campestris*)**

Abdullah Adil Ansari (2008). Present investigations were carried out during 1998-2000 at Shivri farm of Uttar Pradesh Bhumi Sudhar Nigam, Lucknow, India, to study the effect of vermicompost application in reclaimed sodic soils on the productivity of potato (*Solanum tuberosum*), spinach (*Spinacia oleracea*) and turnip (*Brassica campestris*). The soil quality was monitored during the experiment followed by productivity. The treatments were 4, 5 and 6 tonnes/ha of vermicompost as soil application in plots already reclaimed by Vermitechnology. Among the different dosages of vermicompost applied there has been a significant improvement in the soil quality of plots amended with vermicompost @ 6 tonnes per ha. The overall productivity of vegetable crops during the two years of the trial was significantly greater in plots treated with vermicompost @ 6 tonnes per ha. The present investigation showed that the requirement of vermicompost for leafy crops like spinach was lower (4 tonnes/ha), whereas that for tuber crops like potato and turnip was higher (6 tonnes/ha).

Manh, Vo. H. and Wang, C. Ho. (2013). This study was conducted in National Pingtung University of Science and Technology during winter season to determine the effect of vermicompost on productivity of muskmelon seedling (*Cucumis melo* L.). Vermicompost produced from rice waste, were mixed at rate of different concentration into rice hulls ash and coconut husk. The pH, electrolytic conductivity (EC), water holding capacity (WHC), concentration of macro-micronutrient in substrates, vegetative growth, plant biomass, concentration of total macro-micronutrient in shoot were recorded. The result showed that using substrate that mixture of vermicompost with rice hulls ash and coconut husk following rate 1:1:1 respectively gave highest value of germination rate, plant height, leaf area, plant biomass and the concentration of P, K, Ca and Fe. Factors contributed to the in increasing of muskmelon seedling growth may be result of an improvement of physical and chemical properties of the substrate when combination between vermicompost, rice hull ash and coconut husk.

 

**Table 1. NPK value of vermicompost compared with conven-tional cattle dung compost made from cattle dung.**

| SL.No. | Nutrients | Cattle Dung Compost | Vermicompost |
|---|---|---|---|
| **01** | Nitrogen | 0.4-1.0% | 2.5-3.0% |
| **02** | Phosphorus | 0.4-0.8% | 1.8-2.9% |
| **03** | Potassium sulfate | 0.8-1.2% | 1.4-2.0% |

**Agarwal (1999)**

**Table 2. Comparison between nutritive values of the end products of conventional composting and vermicomposting systems (CNP in %; Others in mg/100 gm of compost).**

| SL.No. | Parameter | Conventional Composting (%) | Vermicomposing (%) |
|---|---|---|---|
| **01** | **Total Carbon (C)** | 9.34 | 13.5 |
| **02** | **Total Nitrogen (N)** | 1.05 | 1.33 |
| **03** | **Available Phosphorus (P)** | 0.32 | 0.47 |
| **04** | **Iron (Fe)** | 587.87 | 746.2 |
| **05** | **Zinc (Zn)** | 12.7 | 16.19 |
| **06** | **Manganese (Mn)** | 35.25 | 53.86 |
| **07** | **Copper (Cu)** | 4.42 | 5.16 |
| **08** | **Magnesium (Mg)** | 689.32 | 832.48 |

**Jadia & Fulekar (2008)**

## Advantages of vermicompost in the field of vegetables crop:

1. Vermicompost is rich in all essential plant nutrients.
2. Provides excellent effect on overall plant growth encourages the growth of new shoots / leaves and improves the quality and shelf life of the produce.
3. Vermicompost is free flowing, easy to apply, handle and store and does not have bad odour. It provides efficient conversion of organic wastes/crop/animal residues.
4. It improves soil structure, texture, aeration, and water holding capacity and prevents soil erosion. It is a stable and enriched soil conditioner. It helps in reducing population of pathogenic microbes.
5. Vermicompost is rich in beneficial micro flora such as a fixers, P- solubilizers, cellulose decomposing micro-flora etc in addition to improve soil environment.
6. Vermicompost contains earthworm cocoons and increases the population and activity of earthworm in the soil.
7. It neutralizes the soil protection. It helps in reducing the toxicity of heavy metals.
8. It prevents nutrient losses and increases the use efficiency of chemical fertilizers.
9. Vermicompost is free from pathogens, toxic elements, weed seeds etc.

 

10. Vermicompost minimizes the incidence of pest and diseases.
11. It is economically viable and environmentally safe nutrient supplement for organic food production. It is an easily adoptable low cost technology.

## II. Conclusion

Concluded that the increase in growth, yield and quality of vegetable crops with addition of vermicompost as compared to using chemical fertilizers. Addtition of vermicompost into vegetables crop field with N, P,K nutrients could be very effective response on the growth of vegetables crops. The mineralization of organic matter, decrease of soil pH by organic acids produced in vermicompost and increases micronutrient complexes formation (Gopal Reddy and Suryanarayan Reddy, 1998; Wong *et al.*,1999). According to experiment results positive effect of vermicompost on photosynthesis pigments of Vegetable crops is recommended the study of vermicompost effects on seed germination and pH of vermicompost , as compared with chemical fertilizers and manure in the case of vegetable crops examined. Effects of vermicompost in farm is being studied.

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